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(54) Lamp fuel composition for producing colored flames and manufacturing method thereof

(57) The present invention discloses a lamp fuel composition for producing colored flames comprising a coloring agent, a fuel, a fuel supporter, a capillary linker and a scent and obtainable by heating the ingredients while stirring and cooling, and a method of manufacturing the same. The composition for producing colored flame can provide stably and continuously flames of different colors such as red, green, orange, yellow, blue, violet, light purple, white rose and rainbow color according to the used coloring agents, upon burning. The composition is useful as decorative illumination.

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Description

BACKGROUND OF THE INVENTION

TECHNICAL FIELD

[0001] The present invention relates to a lamp fuel composition for producing colored flames and a method of manufacturing the same. More particularly, this invention relates to a lamp fuel composition for producing brilliantly colored flames for interior decoration or various festivals and a desirable method of manufacturing the same.

BACKGROUND ART

[0002] In the prior art, several oils for producing colored flames when used in wick-equipped oil lamps for interior décor or festive decorations have been disclosed (for example, Korean Application for Patent. Nos. 2001-1240 and 2000-73621). However, the oils can only generate red and green flames. Moreover, metal-containing colloidal solutions serving as coloring agents in those applications are prepared by electrolyzing metal salts in alcoholic solutions and heating in a sealed high pressure oven. Thus, the coloring salts are not evenly dispersed in the colloidal solutions. Consequently, the compositions have defects that upon burning, flames are not stably produced and the colors of flames are not clean nor clear. Also, the oil can hardly be preserved for a long time because the solvent included therein is poor in stability.

SUMMARY OF THE INVENTION

[0003] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a lamp fuel composition which is capable of producing stably and continuously colored flames, of which colors are clean and brilliant, by improving dispersion of a coloring salt in a colloidal solution acting as a coloring agent, and a method for producing the same.

[0004] It is another object of the present invention to provide a lamp fuel composition which can be preserved for a prolonged time and produce stably colored flames by suitably controlling the mixing ratio of volatile solvents, and a method for producing the same.

[0005] To achieve the above object, there is provided a lamp fuel composition for producing colored flames upon burning by preparing a colloidal solution having a coloring salt evenly dispersed therein, adding a fuel, a fuel supporter and a scent to the solution, and heating the solution while stirring, followed by cooling.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0006] The present invention is defined by the claims, which are incorporated in their entirety in the specification by reference.

[0007] The present invention is directed to a lamp fuel composition which is produced by a method comprising steps of selecting a coloring agent; preparing a stable coloring colloidal solution of the coloring agent; and adding a fuel, a fuel supporter and a scent to the colloidal solution, heating the solution while stirring, and cooling.

[0008] The coloring agent used in the lamp fuel composition according to the present invention is selected depending on desired colors of flames. The coloring agent may determine the characteristic decorative effects by colors of flames generated when lighting the lamp.

[0009] The composition for producing colored flame can provide flames of different colors such as red, green, orange, yellow, blue, violet, light purple, white rose and rainbow color according to the used coloring agents. The methods for manufacturing the compositions for producing respective colored flames are slightly different from each other.

[0010] Propylene glycol, a kind of glycol, which is used according to the present invention is able to form an ether bond in its molecular structure aspect and has a hydroxy group (-OH) at the end of its structure. Such features allow for this compound to effectively dissolve or disperse a coloring agent and provide optimal stability. However, it has disadvantages that its absorption by wicks may be hindered due to its high viscosity, and fire cannot be readily ignited because of a high ignition temperature. In order to overcome these difficulties, according to the present invention an ether such as ethylene glycol ethyl ether, ethylene glycol monomethyl ether and the like, and an amine such as dimethylformamide, trimethylamine and the like are added in an appropriate ratio to propylene glycol. As a result, the ignitability of the composition is improved and coloring agents can be readily dissolved or dispersed in the solvent. Further, an alcohol such as ethyl alcohol, etc. may be added to maximize the above effect.

[0011] According to a particular embodiment of the present invention, lauryl alcohol is also used to facilitate capillary uptake by the wick since the solvent used in the present invention is poorly absorbed by the wick, though it has advantages of a non-polar chemical structure like petroleum and paraffin and can readily release coloring agents. Lauryl alcohol may be dispersed in propylene glycol, ethylene glycol monoethyl ether, methyl ether, ethyl alcohol and the like without difficulty. Fatty acid of lauryl alcohol may play a role to continuously supply lamp fuel to a wick.

[0012] Camphor is often used as a scent but can also be used as a fuel supporter. Turpentine oil has pine tree scent. It plays a role as an auxiliary scent but also as a

flame enhancer.

[0013] The present composition has advantages that its combustion products are harmless and do not create pollutants nor soot, whereby it is much more hygienic for general use than conventional paraffin or kerosene. Lauryl alcohol and turpentine oil are used to prevent a wick from hardening and consequently, it is possible to use the wick for a prolonged time. Further, advantageously, since glycols used in the fuel composition according to the present invention have a very high ignition temperature, if the lamp containing the composition tips over due to carelessness, fire is not readily spread.

[0014] The fuel used to prepare the stable colloidal solution according to the present invention may include, for example, ethers such dimethyl ether, ethyl methyl ether, diethyl ether, dipropyl ether, diisopropyl ether, dibutyl ether, 1,2-dimethoxyethane, tetrahydrofuran, 1,4-dioxane, methoxybenzene, vinyl isobutyl ether, β,β '-dichlorodiethyl ether, dibromocresyl glicidyl ether and the like; and amines such as poly ether imide, butyl cellosolve, ethyl cellosolve, methylamine, ethylamine, propylamine, isopropylamine, butylamine, isobutylamine, sec-butylamine, tert-butylamine, cyclohexylamine, benzylamine, trimethylamine, triethylamine, tripropylamine, N,N-dimethylaniline, diethylaminoethylamine, α-naphthylamine, 3-methoxy propylamine, alkoxy propylamine, polyoxyethylene oleylamine and the like.

[0015] Also, the fuel (also acting as a fuel supporter) used to ensure the production of stable flames may include, for example, alcohol such as methanol, ethanol, propyl alcohol, isopropyl alcohol, butyl alcohol, isobutyl alcohol, sec-butyl alcohol, tert-butyl alcohol, pentyl alcohol, hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, allyl alcohol, cyclopentanol, cyclohexanol, benzyl alcohol and the like; glycols such as propylene glycol, ethylene glycol, dipropylene glycol, glycerol, diethylene glycol, triethylene glycol, trimethylene glycol, hexylene glycol, butylene glycol, 1,3-butanediol, thiodiethylene glycol, ammonium thioglycolate, ceftatrizine glycol, polypropylene glycol, propylene glycol alginate; dichloromethane; butyl acetate; acetone; acetonitrile; ethyl acetate; and the like.

[0016] The selection and mixing ratio of these fuels can be practiced and modified in any manner by skilled persons in the art after disclosure of the present invention, and thus such practice and modification by the skilled persons come under the scope of the present invention.

[0017] Now, the present invention is described in detail using the following examples.

Example 1: Preparation of a lamp fuel composition for producing red flames

[0018] The lamp fuel composition for producing red flames is constituted as shown in Table 1 below.

Table 1

Ingredients	Ratio (%, w/w)
Lithium salt or strontium salt	0.04 ~ 0.1
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 60
Ethyl cellosolve	20 ~ 30
Dimethylformamide	10 ~ 30
Camphor	0.3 ~ 1
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.2 ~ 2
Total	100

[0019] The fuel composition for producing red flames was prepared as follows. In the step to prepare a coloring agent for generating red flame, ethyl alcohol and a lithium salt or a strontium salt as a coloring salt were put into a container and subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the coloring salt could be dispersed evenly in ethyl alcohol.

[0020] Next, in the step to prepare a stable colloidal coloring solution for lamp fuel, dimethylformamide and ethyl cellosolve were added to the first solution and the resulting solution was treated as described in any one process selected from the following two processes to yield the stable colloidal solution for red flames.

1) The first solution was put into a stirring bath and dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for red flames.

2) The first solution was put into an electrolyzer and dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was electrolyzed using strontium as an anode with a voltage of DC 12V and a current of 10 to 15 A/cm at 30°C for 30 minutes. Then, the solution was heated in a sealed oven under a high pressure at about 250°C to yield the stabilized colloidal solution for red flames.

[0021] Finally, the stabilized colloidal solution obtained from either 1) or 2) process was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0022] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides brilliant red flames by the action of the coloring colloidal

solution containing the lithium salt or strontium salt. For all that the amount of the coloring salts used in the composition of the present invention is smaller than that used in a cosmetic composition (0.04 to 0.1 % by weight), it generates brilliant red flames, whereby it can be used for decorative illumination.

[0023] The coloring agent which can be used to produce red flames includes lithium salts, for example lithium acetate, lithium acetoacetate, lithium acetylacetonate, lithium amide, lithium chloride, lithium fluoride, lithium nitrate, lithium sulfate and the like, or strontium salts, for example strontium acetate, strontium acetylacetonate, strontium carbonate, strontium chloride, strontium nitrate, strontium oxalate, strontium sulfate and the like.

Example 2: Preparation of a lamp fuel composition for producing green flames

[0024] The lamp fuel composition for producing green flames is constituted as shown in Table 2 below.

Table 2

Ingredients	Ratio (%, w/w)
Boric acid	3.5 ~ 4
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 60
Ethyl cellosolve	20 ~ 30
Butanol	10 ~ 30
Camphor	0.3 ~ 1
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.2 ~ 2
Total	100

[0025] The fuel composition for producing green flames was prepared as follows. In the step to prepare a coloring agent for generating green flames, boric acid was put into a container containing ethyl alcohol and completely dissolved while stirring at room temperature or 40 to 50°C. The solution was then subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the boric acid could be dispersed evenly in ethyl alcohol.

[0026] In the step to prepare a stable colloidal coloring solution for lamp fuel, the first solution was put into a stirring bath and butanol and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for green flames.

[0027] Finally, the stabilized colloidal solution was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0028] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides brilliant green flames by the coloring colloidal solution containing boric acid. Boric acid used as a coloring agent in the present invention is a non-toxic and harmless substance, which is used in cosmetic products, preservatives, toothpastes, disinfectants and the like. Thus, the composition can be used for both indoor and outdoor decoration.

[0029] Also, when the fuel composition is burned, the boric acid is burned well at a temperature of a lamp wick. Therefore, the wick can be prevented from being hardened.

[0030] There are known several metallic salts other than boric acid which can produce green flames. They cannot be used owing to the poor flame stability.

Example 3: Preparation of a lamp fuel composition for producing orange colored flames

[0031] The lamp fuel composition for producing orange colored flames is constituted as shown in Table 3 below.

Table 3

Ingredients	Ratio (%, w/w)
Borax	0.02 ~ 0.1
Sodium salt	0.02 ~ 0.1
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 60
Ethyl cellosolve	20 ~ 30
Butanol	5 ~ 10
Camphor	0.5 ~ 1
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.3 ~ 0.5
Total	100

[0032] The fuel composition for producing orange colored flames was prepared as follows. In the step to prepare a coloring agent for generating orange colored flames, borax and a sodium salt were put into a container containing ethyl alcohol and completely dissolved while stirring at room temperature or 40 to 50°C. The solution was then subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the borax and sodium salt could be dispersed evenly in ethyl alcohol.

[0033] In the step to prepare a stable colloidal coloring solution for lamp fuel, the first solution was put into a stirring bath and butanol and ethyl cellosolve were add-

ed at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for orange colored flames.

[0034] Finally, the stabilized colloidal solution was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0035] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides brilliant orange colored flames by the coloring colloidal solution containing the borax and sodium salt as coloring agents. Borax and sodium salts used as a coloring agent in the present invention are non-toxic and harmless substances, which do not yield combustion products harmful to human bodies. Also, when the fuel composition is burned the borax and sodium salts are burned well at a temperature of a lamp wick. Therefore, the wick can be advantageously prevented from being hardened.

[0036] The coloring agent which can be used to produce orange colored flames may be selected from borax and sodium salts, for example sodium chloride, sodium acetate, sodium amide, sodium cyanide, sodium nitrate and the like.

Example 4: Preparation of a lamp fuel composition for producing yellow flames

[0037] The lamp fuel composition for producing yellow flames is constituted as shown in Table 4 below.

Table 4

Ingredients	Ratio (%, w/w)
Barium salt	0.02 ~ 0.1
Calcium salt	0.02 ~ 0.1
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 60
Ethyl cellosolve	20 ~ 40
Butanol	10 ~ 20
Camphor	0.5 ~ 1
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.3 ~ 0.5
Total	100

[0038] The fuel composition for producing yellow flames was prepared as follows. In the step to prepare a coloring agent for generating yellow flames, a barium salt and a calcium salt as coloring salts were put into a container containing ethyl alcohol and completely dissolved while stirring at room temperature or 40 to 50°C. The solution was then subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the coloring salts could be dispersed evenly in ethyl alcohol.

[0039] In the step to prepare a stable colloidal coloring solution for lamp fuel, the first solution was put into a stirring bath and butanol and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for yellow flames.

[0040] Finally, the stabilized colloidal solution was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0041] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides tender yellow colored flames by the coloring colloidal solution containing the barium salt and calcium salt.

[0042] The coloring agent which can be used to produce yellow flames may include barium salts, for example barium acetate, barium chloride, barium fluoride, barium nitrate, barium oxalate, barium sulfate and the like, and calcium salts, for example calcium acetate hydrate, calium fluoride, calcium nitrate, calcium oxalate, calcium sulfate and the like.

Example 5: Preparation of a lamp fuel composition for producing blue flames

[0043] The lamp fuel composition for producing blue flames is constituted as shown in Table 5 below.

Table 5

Ingredients	Ratio (%, w/w)
Copper salt	0.04 ~ 0.1
Butanol	5 ~ 10
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 55
Ethyl cellosolve	25 ~ 35
Dimethylformamide	5 ~ 10
Camphor	0.3 ~ 1.0
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.1 ~ 0.5
Total	100

[0044] The fuel composition for producing blue flames was prepared as follows. In the step to prepare a coloring agent for generating blue flame, ethyl alcohol and a copper salt as a coloring salt were put into a container and subjected to an ultrasonic treatment at 30°C for 30

minutes to yield a first solution. Through this process, the copper salt could be dispersed evenly in ethyl alcohol.

[0045] Next, in the step to prepare a stable colloidal coloring solution for lamp fuel, dimethylformamide and ethyl cellosolve were added to the first solution and the resulting solution was treated as described in any one process selected from the following two processes to yield the stable colloidal solution for blue flames.

1) The first solution was put into a stirring bath and dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for red flames.
2) The first solution was put into an electrolyzer and dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was electrolyzed using metallic copper as an anode with a voltage of DC 12V and a current of 10 to 15 A/cm at 30°C for 30 minutes. Then, the solution was heated in a sealed oven under a high pressure at about 250°C to yield the stabilized colloidal solution for blue flames.

[0046] Finally, the stabilized colloidal solution obtained from either 1) or 2) process was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0047] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides bright blue flames.

[0048] The coloring agent which can be used to produce blue flames may be selected from copper salts, for example copper acetate, copper acetylacetonate, copper chloride, copper cyanide, copper hydroxide, copper sulfate, copper trifluoroacetylacetonate, copper nitrate and the like.

Example 6: Preparation of a lamp fuel composition for producing violet flames

[0049] The lamp fuel composition for producing violet flames is constituted as shown in Table 6 below.

Table 6

Ingredients	Ratio (%, w/w)
Potassium salt	0.1 ~ 0.5
Cerium salt	0.5 ~ 1.0
Butanol	10 ~ 15
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 55
Ethyl cellosolve	20 ~ 30
Dimethylformamide	5 ~ 10
Camphor	0.3 ~ 1.0
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.1 ~ 0.5
Total	100

[0050] The fuel composition for producing violet flames was prepared as follows. In the step to prepare a coloring agent for generating violet flames, a potassium salt and a cerium salt were put into a container containing ethyl alcohol and completely dissolved while stirring at room temperature or 40 to 50°C. The solution was then subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the coloring salts could be dispersed evenly in ethyl alcohol.

[0051] In the step to prepare a stable colloidal coloring solution for lamp fuel, the first solution was put into a stirring bath and butanol, dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for violet flames.

[0052] Finally, the stabilized colloidal solution was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0053] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides fabulous violet flames by the coloring colloidal solution containing the potassium nitrate and cerium salt.

[0054] The coloring agent capable of producing violet flames according to the present invention is cerium salts and potassium salts. Examples of the cerium salts which can be used include cerium acetate hydrate, cerium acetylacetonate hydrate, cerium chloride, cerium nitrate, cerium oxalate, cerium sulfate and the like, and examples of the cerium salts which can be used include potassium acetate, potassium acetylacetonate hemihydrate, potassium chloride, potassium chlorate, potassium cyanide, potassium ethoxide, potassium ferricyanide, potassium fluoride, potassium oxalate monohydrate, potassium sulfate, potassium sodium tartrate tetrahydrate, potassium nitrate and the like.

Example 7: Preparation of a lamp fuel composition for producing light purple flames

[0055] The lamp fuel composition for producing light

purple flames is constituted as shown in Table 7 below.

Table 7

Ingredients	Ratio (%, w/w)
Cesium salt	0.5 ~ 1.0
Butanol	10 ~ 15
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 55
Ethyl cellosolve	20 ~ 30
Dimethylformamide	5 ~ 10
Camphor	0.3 ~ 1.0
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.1 ~ 0.5
Total	100

[0056] The fuel composition for producing light purple flames was prepared as follows. In the step to prepare a coloring agent for generating light purple flames, a cesium salt was put into a container containing ethyl alcohol and completely dissolved while stirring at room temperature or 40 to 50°C. The solution was then subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the coloring salt could be dispersed evenly in ethyl alcohol.

[0057] In the step to prepare a stable colloidal coloring solution for lamp fuel, the first solution was put into a stirring bath and butanol, dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for light purple flames.

[0058] Finally, the stabilized colloidal solution was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0059] The composition thus obtained is a colorless transparent liquid and upon burning in the air, provides light purple flames by the coloring colloidal solution containing the cesium salt.

[0060] The coloring agent used to produce light purple flames according to the present invention is cesium salts. Examples of the cesium salts include cesium acetate, cesium acetylacetonate, cesium chloride, cesium fluoride, cesium sulfate, cesium nitrate, cesium oxalate and the like.

Example 8: Preparation of a lamp fuel composition for producing white rose colored flames

[0061] The lamp fuel composition for producing white rose colored flames is constituted as shown in Table 8 below.

Table 8

Ingredients	Ratio (%, w/w)
Nitromethane	50 ~ 60
Ethyl alcohol	5 ~ 10
Dimethylformamide	30 ~ 40
Camphor	0.5 ~ 1.0
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.3 ~ 0.5
Total	100

[0062] The fuel composition for producing white rose colored flames was prepared as follows. In the step to prepare a stable colloidal coloring solution for producing white rose colored flames, nitromethane was put into a polymerizing reactor and dimethylformamide and ethyl alcohol were added at 40 to 50°C. The resulting solution was heated stirred at 50 to 250 rpm for 10 minutes. Camphor, lauryl alcohol and turpentine oil were added to the solution and reheated for 20 minutes while stirring and cooled to room temperature.

[0063] The white rose colored flames according to the present invention were seen as white flames in general with slight red tincture at the edge.

Example 9: Preparation of a lamp fuel composition for producing rainbow colored flames

[0064] The lamp fuel composition for producing rainbow colored flames is constituted as shown in Table 9 below.

Table 9

Ingredients	Ratio (%, w/w)
Lithium salt or strontium salt	0.04 ~ 0.1
Boric acid	3 ~ 4
Copper salt	0.01 ~ 0.05
Ethyl alcohol	5 ~ 10
Propylene glycol	40 ~ 60
Ethyl cellosolve	20 ~ 30
Dimethylformamide	10 ~ 30
Camphor	0.3 ~ 1.0
Turpentine oil	0.01 ~ 0.1
Lauryl alcohol	0.2 ~ 2
Total	100

[0065] The fuel composition for producing rainbow colored flames was prepared as follows. In the step to

select a coloring agent for generating rainbow colored flames, either lithium salt or strontium salt and a copper salt were selected. The selected coloring salts along with boric acid were put into a container containing ethyl alcohol and completely dissolved while stirring at room temperature or 40 to 50°C. The solution was then subjected to an ultrasonic treatment at 30°C for 30 minutes to yield a first solution. Through this process, the coloring salts could be dispersed evenly in ethyl alcohol.

[0066] In the step to prepare a stable colloidal coloring solution for lamp fuel, the first solution was put into a stirring bath and dimethylformamide and ethyl cellosolve were added at 40 to 50°C. The resulting solution was stirred at 50 to 250 rpm to yield the stabilized colloidal solution for rainbow colored flames.

[0067] Finally, the stabilized colloidal solution was put into a polymerizing reactor and at 50 to 60°C, propylene glycol was slowly added while stirring at 50 to 250 rpm. After stirring for 10 minutes, camphor, lauryl alcohol and turpentine oil were added. The solution was reheated for 20 minutes while stirring and cooled to room temperature.

[0068] The composition thus obtained is a clear green liquid and upon burning in the air, provides fabulous rainbow colored flames by the coloring colloidal solution containing the lithium (or strontium) salt, copper salt and boric acid. The rainbow colored flames are composed of a lower part of a red color, a middle part having colors of yellow, blue, purple, etc. and an upper part of a green color.

[0069] The coloring agents which can be used to produce rainbow colored flames include lithium salts and strontium salts for producing red flames and copper salts and boric acid for producing blue flames.

[0070] As described above, the composition of lamp fuel for producing colored flames according to the present invention does not use any metallic salts harmful to humans but uses a colloidal solution prepared using an extremely small quantity of a coloring agent. Therefore, its combustion products are harmless. Also, it does not create pollutants, contaminate the air or produce odor and smoke. Further, since the coloring salts are homogeneously dispersed in the colloidal solution, the colored flames can be not only stably formed but seen clearly and cleanly. Accordingly, the present invention can provide a lamp fuel composition suitable for festival or interior decoration. Also, the lamp fuel composition can be used stably and continuously for a prolonged time because the wick is not hardened. In addition, since upon preparation its composition and ignition temperature are optimally controlled so that the composition has a high ignition temperature, if the lamp wherein the composition is contained tips over due to carelessness, fire is not readily spread. Thus, the composition has a fire protective effect.

Claims

1. A lamp fuel composition for producing colored flames comprising by weight percent, 0.01 to 4 % of at least one coloring agent; 5 to 40 % of at least one fuel ; 5 to 60 % of at least one fuel optionally acting as a fuel supporter ; 0.01 to 1 % of at least one scent.

2. A lamp fuel composition as set forth in claim 1, wherein the coloring agent is independently selected from the group consisting of a lithium salt or strontium salt, boric acid, borax sodium salt, barium salt, calcium salt, copper salt, potassium salt, cerium salt, cesium salt, nitromethane.

3. A lamp fuel composition as set forth in any one of the preceding claims, wherein the fuel is selected independently from the group consisting of ethers such dimethyl ether, ethyl methyl ether, diethyl ether, dipropyl ether, diisopropyl ether, dibutyl ether, 1,2-dimethoxyethane, tetrahydrofuran, 1,4-dioxane, methoxybenzen, vinyl isobutyl ether, β,β'-dichlorodiethyl ether, dibromocresyl glicidyl ether and the like; and amines such as poly ether imide, butyl cellosolve, ethyl cellosolve, methylamine, ethylamine, propylamine, isopropylamine, butylamine, isobutylamine, sec-butylamine, tert-butylamine, cyclohexylamine, benzylamine, trimethylamine, triethylamine, tripropylamine, N,N-dimethylaniline, diethylaminoethylamine, α -naphthylamine, 3-methoxy propylamine, alkoxy propylamine, polyoxyethylene oleylamine.

4. A lamp fuel composition as set forth in any one of the preceding claims, wherein the fuel optionally acting as a fuel supporter is selected independently from the group consisting of alcohols such as dichloromethane, butyl acetate, acetone, acetonitrile, ethyl acetate, methanol, ethanol, propyl alcohol, isopropyl alcohol, butyl alcohol, isobutyl alcohol, sec-butyl alcohol, tert-butyl alcohol, pentyl alcohol, hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, allyl alcohol, cyclopentanol, cyclohexanol, benzyl alcohol and the like; and glycols such as propylene glycol, ethylene glycol, dipropylene glycol, glycerol, diethylene glycol, triethylene glycol, trimethylene glycol, hexylene glycol, butylenes glycol, 1,3-butanediol, thiodiethylene glycol, ammonium thioglycolate, cefatrizine glycol, polypropylene glycol, propylene glycol alginate; dichloromethane, butyl acetate, acetone, acetonitrile, ethyl acetate.

5. A lamp fuel composition as set forth in any one of the preceding claims, wherein the scent is independently selected from the group consisting of camphor and turpentine oil.

6. A lamp fuel composition as set forth in any one of the preceding claims, wherein lauryl alcohol is present, preferably from 0.1 to 2 % by weight.

7. A lamp fuel composition for producing red flames comprising 0.04 to 0.1 % by weight of a lithium or strontium salt, 40 to 60 % by weight of propylene glycol, 20 to 30 % by weight of ethyl cellosolve, 10 to 30 % by weight dimethylformamide, 0.3 to 1 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil, 0.2 to 2 % by weight of lauryl alcohol and 5 to 10 % by weight of ethyl alcohol.

8. A lamp fuel composition for producing green flames comprising 3.5 to 4 % by weight of boric acid, 40 to 60 % by weight propylene glycol, 20 to 30 % by weight of ethyl cellosolve, 10 to 30 % by weight of butanol, 5 to 10 % by weight of ethyl alcohol, 0.3 to 1 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.2 to 2 % by weight of lauryl alcohol.

9. A lamp fuel composition for producing orange colored flames comprising 0.02 to 0.1 % by weight of borax, 0.02 to 0.1 % by weight of a sodium salt, 5 to 10 % by weight of ethyl alcohol, 40 to 60 % by weight of propylene glycol, 20 to 30 % by weight of ethyl cellosolve, 5 to 10 % by weight of butanol, 0.5 to 1 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.3 to 0.5 % by weight of lauryl alcohol.

10. A lamp fuel composition for producing yellow flames comprising 0.02 to 0.1 % by weight of a barium salt, 0.02 to 0.1 % by weight of a calcium salt, 5 to 10 % by weight of ethyl alcohol, 40 to 60 % by weight of propylene glycol, 20 to 40 % by weight of ethyl cellosolve, 10 to 20 % by weight of butanol, 0.5 to 1 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.3 to 0.5 % by weight of lauryl alcohol.

11. A lamp fuel composition for producing blue flames comprising 0.04 to 0.1 % by weight of a copper salt, 5 to 10 % by weight of ethyl alcohol, 40 to 55 % by weight of propylene glycol, 25 to 40 % by weight of ethyl cellosolve, 5 to 10 % by weight of butanol, 5 to 10 % by weight of dimethylformamide, 0.3 to 1.0 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.1 to 0.5 % by weight of lauryl alcohol.

12. A lamp fuel composition for producing violet flames comprising 0.1 to 0.5 % by weight of a potassium salt, 0.5 to 1.0 % by weight of a cerium salt, 5 to 10 % by weight of ethyl alcohol, 40 to 55 % by weight of propylene glycol, 10 to 15 % by weight of butanol, 20 to 30 % by weight of ethyl cellosolve, 5 to 10 % by weight of dimethylformamide, 0.3 to 1.0 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.1 to 0.5 % by weight of lauryl alcohol.

13. A lamp fuel composition for producing light purple flames comprising 0.5 to 1.0 % by weight of a cesium salt, 5 to 10 % by weight of ethyl alcohol, 40 to 55 % by weight of propylene glycol, 10 to 15 % by weight of butanol, 20 to 30 % by weight of ethyl cellosolve, 5 to 10 % by weight of dimethylformamide, 0.3 to 1.0 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.1 to 0.5 % by weight of lauryl alcohol.

14. A lamp fuel composition for producing white rose colored flames comprising 50 to 60 % by weight of nitromethane, 5 to 10 % by weight of ethyl alcohol, 20 to 40 % by weight of dimethylformamide, 0.5 to 1.0 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.3 to 0.5 % by weight of lauryl alcohol.

15. A lamp fuel composition for producing rainbow colored flame comprising 0.04 to 0.1 % by weight of a lithium or strontium salt, 3 to 4 % by weight of boric acid, 0.01 to 0.05 % by weight of a copper salt, 5 to 10 % by weight of ethyl alcohol, 40 to 60 % by weight of propylene glycol, 20 to 30 % by weight of ethyl cellosolve, 10 to 30 % by weight of dimethylformamide, 0.3 to 1.0 % by weight of camphor, 0.01 to 0.1 % by weight of turpentine oil and 0.2 to 2 % by weight of lauryl alcohol.

16. A method for producing a lamp fuel composition for producing colored flames, the method comprising the steps of:

(a) putting ethyl alcohol and at least one coloring agent into a reactor, dissolving the contents while stirring at room temperature or 40 to 50°C, and applying ultrasonic waves to form a first solution;
(b) either (i) placing the first solution into a stirring bath and adding at least one fuel while stirring to form a stabilized colloidal solution; or (ii) placing the first solution into an electrolyzer, adding a fuel, and electrolyzing metallic salts to form a stabilized colloidal solution; and
(c) adding at least one fuel supporter and at least one scent to the stabilized colloidal solution produced in step (b), followed by heating with stirring and cooling to room temperature.

17. The method as set forth in claim 16, wherein the fuel which can be used in the steps (b) (i) and (ii) is one independently selected from the group consisting of ethers such as dimethyl ether, ethyl methyl

ether, diethyl ether, dipropyl ether, diisopropyl ether, dibutyl ether, 1,2-dimethoxyethane, tetrahydrofuran, 1,4-dioxane, methoxybenzen, vinyl isobutyl ether, β,β'-dichlorodiethyl ether, dibromocresyl glicidyl ether and the like; and amines such as poly ether imide, butyl cellosolve, ethyl cellosolve, methylamine, ethylamine, propylamine, isopropylamine, butylamine, isobutylamine, sec-butylamine, tert-butylamine, cyclohexylamine, benzylamine, trimethylamine, triethylamine, tripropylamine, N,N-dimethylaniline, diethylaminoethylamine, α -naphthylamine, 3-methoxy propylamine, alkoxy propylamine, polyoxyethylene oleylamine.

18. The method as set forth in claim 16, wherein the fuel which can be used in the step (c) is one selected from the group consisting of alcohols such as methanol, ethanol, propyl alcohol, isopropyl alcohol, butyl alcohol, isobutyl alcohol, sec-butyl alcohol, tert-butyl alcohol, pentyl alcohol, hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, decyl alcohol, allyl alcohol, cyclopentanol, cyclohexanol, benzyl alcohol and the like; and glycols such as propylene glycol, ethylene glycol, dipropylene glycol, glycerol, diethylene glycol, triethylene glycol, trimethylene glycol, hexylene glycol, butylenes glycol, 1,3-butanediol, thiodiethylene glycol, ammonium thioglycolate, cefatrizine glycol, polypropylene glycol, propylene glycol alginate; dichloromethane, butyl acetate, acetone, acetonitrile, ethyl acetate.

19. The method as set forth in claim 16, wherein the scent is one selected from the group consisting of camphor and turpentine oil.